

REMARKS

The Office Action mailed August 28, 2000 ("the Office Action"), has been received and reviewed. Claims 25, 26, 31 through 34, 37 through 40, and 43 through 45 are currently pending in the application. Claims 25, 26, 31 through 34, 37 through 40, and 43 through 45 stand rejected. Applicants have amended claims 25, 33, and 39, added claims 46 through 49, and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 103(a) Obviousness Rejections

Each of claims Claims 25, 26, 31 through 34, 37 through 40, and 43 through 45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over various combinations of Tada (U.S. Patent No. 5,545,577), Koike (U.S. Patent No. 5,874,325), and Shim et al. (U.S. Patent No. 5,846,596). However, Applicants respectfully submit that the combinations of references cited in the Office Action do not properly establish a *prima facie* case of obviousness against the rejected claims in light of the amendments made herein. Applicants, therefore, respectfully traverse the rejections of claims 25, 26, 31 through 34, 37 through 40, and 43 through 45, and respectfully request that these rejections be withdrawn.

As is set forth in M.P.E.P. § 706.02(j), *prima facie* obviousness can not be established unless three criteria are met.

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

In the instant case however, in light of the amendments made to claims 25, 33, and 39, none of the cited combinations of references teach or suggest all of the limitations recited in any one of claims 25, 26, 31 through 34, 37 through 40, and 43 through 45. Therefore, Applicants

respectfully submit that the references cited in the Office Action do not properly establish the *prima facie* obviousness of the rejected claims.

Each of the rejected claims recite a pre-anneal intermediate structure used in the formation of an isolation structure for a semiconductor device. Significantly, in light of the amendments to claims 25, 33, and 39, each of the structures recited in the rejected claims comprises a semiconductor substrate, which is free of field oxide structures and has first and second opposing surfaces, at least one first doped area on the substrate first surface, at least one second, differently doped area within said at least one first doped area, and a substantially dopant-free, uninterrupted diffusion barrier layer extending over both the first and second surfaces of the semiconductor substrate. However, none of the references cited in the Office Action, whether considered alone or in combination, teach or suggest a pre-anneal intermediate structure having such characteristics.

For example, when the amendments to claims 25, 33, or 39 are considered, Applicants respectfully submit that Tada does not teach or suggest each of the limitations recited in any one of the rejected claims. Specifically, Tada does not teach a pre-anneal intermediate structure including a substantially dopant-free, uninterrupted diffusion barrier layer extending over the first and second opposing surfaces of a semiconductor substrate. Moreover, the only material layer taught in Tada that might arguably be considered a substantially dopant-free diffusion barrier layer is deposited over field oxide structures formed on a semiconductor substrate. (*See*, col. 5 - col. 6, FIG. 3a and FIG. 3b). Consequently, applicants respectfully submit that Tada does not teach or suggest all of the limitations recited in any one of the rejected claims.

Applicants respectfully emphasize that the substantially dopant-free, uninterrupted diffusion barrier layer and lack of field oxide structures in the pre-anneal intermediate structures recited in the pending claims are of significance. The pre-anneal structures recited in the pending claims, which include a substantially dopant-free, uninterrupted diffusion barrier layer, substantially reduce or eliminate dopant contamination of process equipment or other intermediate structures present during a subsequent anneal step, a problem that is not addressed or considered in the cited references. (*See, Specification*, pp. 8). Further, the pre-anneal

intermediate structures recited in the pending claims do not include field isolation structures because they are subjected to an anneal process before definition of device areas and formation of field isolation structures. As is taught and illustrated in the present application, creation of device areas and field isolation structures after forming and annealing the pre-anneal intermediate structures recited in the pending claims substantially reduces encroachment of field isolation structures into the device areas. (See, *Specification*, pp. 9, 10; FIG. 9 - FIG. 12) using the pre-anneal intermediate structures recited in the claims pending in this application. Again, none of the references cited in the Office Action address such concerns.

Further, the teachings of Koike do not combine with the teachings of Tada to teach or suggest all of the limitations of any one of the rejected claims. In particular, although Koike teaches the deposition of silicon nitride film on both the first and second surfaces of a semiconductor substrate, the silicon nitride film formed over the first surface is substantially compromised during the formation of field oxide regions and then entirely removed before first and second doped areas are formed on the semiconductor substrate. Koike, therefore, teaches away from the intermediate structure recited in the rejected claims, and Applicants respectfully submit that the combined teachings of Tada and Koike do not teach or suggest all of the limitations of any one of claims 25, 26, 31 through 34, 37 through 40, and 43 through 45.

Finally, Applicants respectfully submit that the teachings of Shim et al. do not combine with the teachings of Tada or Koike to teach or suggest all of the limitations recited in the rejected claims. Shim et al. teaches a method of forming field oxide isolation regions having sloped edges. During the process taught by Shim, oxide layers and non-oxidative nitride layers are formed over the semiconductor substrate surface. However, the only method taught in Shim et al. requires the formation a field oxide structure which defines areas on the surface of a semiconductor substrate which are to be **subsequently** doped (col. 3. Lines 26-32). Moreover, Shim et al. is devoid of any teaching or suggestion that would motivate one of ordinary skill in the art to form a diffusion barrier layer over the semiconductor substrate before an annealing step. Thus, like Koike, Shim et al. teaches away from the structures recited in the rejected claims and the teachings of Shim et al. do nothing to remedy the deficiencies of Tada and Koike.

Applicants respectfully request that the rejections of claims 25, 26, 31 through 34, 37 through 40, and 43 through 45 under Section 103(a) be withdrawn. The combined teachings of the references cited against the rejected claims simply do not teach or suggest each and every limitation recited in claims 25, 26, 31 through 34, 37 through 40, and 43 through 45, particularly when the amendments to claims 25, 33, and 39 are considered. Applicants, therefore, respectfully submit that the references cited in the Office Action do not create a *prima facie* case of obviousness against claims 25, 26, 31 through 34, 37 through 40, and 43 through 45, and Applicants respectfully request that rejections of these claims be withdrawn.

CONCLUSION

Claims 25, 26, 31 through 34, 37 through 40, and 43 through 45 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully Submitted,



Samuel E. Webb -
Registration Number 44,394
Attorney for Applicants
TRASK BRITT -
P.O. Box 2550
Salt Lake City, Utah 84110
Telephone: (801) 532-1922

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